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WEST COAST FOREST HEALTH MONITORING
EVALUATION MONITORING PROJECT

Ground Verification of Aerial Survey for Port-Orford-Cedar Root Disease in Southwest Oregon

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PORT-ORFORD-CEDAR ROOT DISEASE

Port-Orford-cedar (POC) (*Chamaecyparis lawsoniana*) is limited in its natural range to southwest Oregon and northwest California. It is highly susceptible to the

root pathogen, *Phytophthora lateralis*, a fatal root rot that kills most trees. The disease is spread by movement of soil, wood, and water. It is common along roadsides and roadsides, and is spread by the turn of the wheel, which causes aerial



Native range of POC.

Native POC extends from southwest Oregon into northwest California.



Symptoms of POC root disease.

Symptoms of infection include discolored cambium and inner bark near the root collar (bottom), and reddish-brown foliage after tree death (top).



OBJECTIVES

The purpose of this project was to describe the reliability of aerial survey information about POC root disease. The two main objectives were to:

- ▶ Determine the relative frequency of mortality caused by POC root disease, black bears, or other agents.
- ▶ Describe the accuracy of aerial sketch mapping from a fixed-wing aircraft.

Many aerial surveys have been used to estimate the distribution of POC root disease. Few of these surveys, however, have been ground-verified. All dead POC mapped in the surveys were presumed to be killed by *P. lateralis*. Damage to POC caused by black bears feeding on the bark can give the same aerial signature as root disease.

METHODS

In 1998, POC mortality was mapped during two aerial surveys flown with 3- or 4-mile intervals between flight lines. The aerial observers drew a figure on the map (called a polygon) showing the area in which recent mortality occurred and



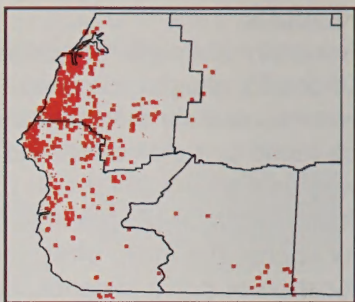
Aerial signature. From the air, both POC root disease and bear damage appear as groups of red trees (recent mortality) and trees that have lost their foliage (old mortality).

Bear damage. Black bears peel POC to feed on the inner bark. If enough of the tree circumference is peeled, the tree will die.



indicated the number of dead trees in that polygon. The sketch maps were digitized into Arcview software.¹ In 1999, we randomly chose 55 polygons from the 1998 surveys for ground verification. The latitude and longitude of the center point of each chosen polygon was determined from the geographical information system (GIS) data and loaded into a hand-held global positioning system (GPS) unit.

Using the GPS unit and the GIS-generated topographic map, the ground crew navigated to the polygon center point. From this point, they searched for the dead trees described by the aerial observers. If no mortality was found within about 0.5 mile of the center point, they considered the accuracy to be unacceptable. If they found a patch of dead trees having the number and distribution pattern indicated on the map, they walked to the apparent center of the patch and determined latitude and longitude with the GPS. This point was considered to be the true polygon center point. The polygon was then searched for all trees that would have appeared as recent mortality in the 1998 aerial surveys. For all trees that had been dead 3 years or less, they noted tree species and cause of death.



Distribution of POC mortality in 1988. Distribution of recent mortality of POC in southwest Oregon as determined by aerial surveys.



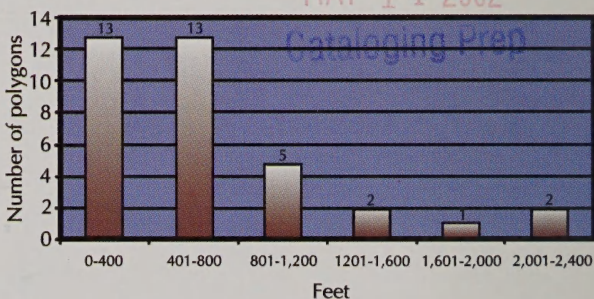
GIS-generated topographic maps. Field crews used topographic maps with overlays of aerial survey polygons to locate polygons on the ground.

¹ The use of trade or firm names in this publication is for reader information and does not imply endorsement by the U.S. Department of Agriculture of any product or service.

RESULTS

Accuracy of Polygon Location

Of the 55 polygons checked, 36 (65 percent) were accurately drawn on the map and could be found by field crews, and 19 (35 percent) were not accurately drawn (they could not be found within about 0.5 mile of the mapped location). The mean difference between the location of polygon center points mapped by aerial observers and those determined by field crews was 664 feet (standard deviation = 574 feet) and ranged from near zero to just less than 0.5 mile. Much of this difference is due to expected errors in sketch-mapping with several miles between flight lines, and to the inherent limited accuracy of hand-held GPS units.



Aerial survey vs. ground polygon location. Difference (in feet) between polygon center points of aerial survey observations and field crew ground checks.

Causes of Mortality

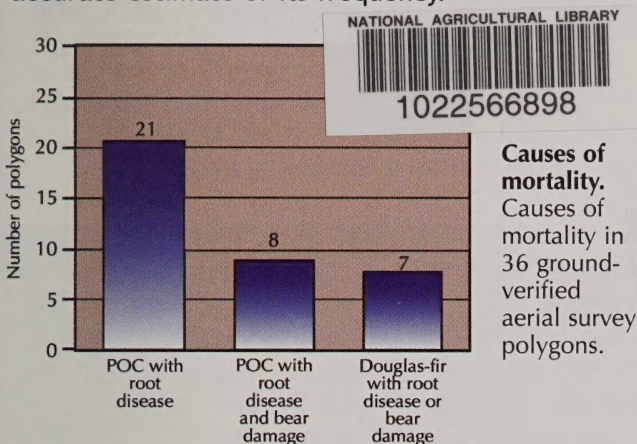
Of the 36 accurately drawn polygons, 58 percent had POC mortality caused by *P. lateralis* only, 33 percent had POC mortality caused by *P. lateralis* and black bear, and 20 percent had mortality of Douglas-fir (*Pseudotsuga menziesii*) caused by black bear or root pathogens. All the checked polygons that contained dead POC had mortality caused by *P. lateralis*. While searching for polygons, however, the field crew

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encountered patches of POC that were damaged or killed by black bears but did not have POC root disease. This occurs occasionally in the area surveyed, but our small sample size did not allow an accurate estimate of its frequency.



The mistaken identification of Douglas-fir for POC in seven polygons is not surprising. The color of recently killed Douglas-fir is almost identical to that of recently killed POC. Observers must distinguish the two species by shape and texture of the crowns, which is particularly difficult in younger trees, especially when flight lines are 3 to 4 or more miles apart. In some cases, observers are mapping dead trees from a distance of 2 miles.

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